INSTRUCTION MANUAL

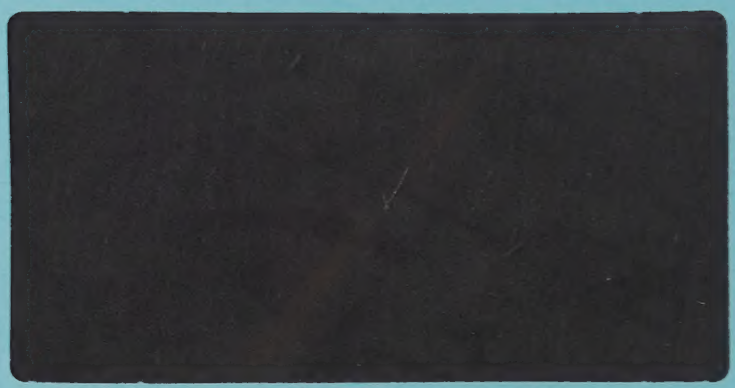
REGULATED POWER SUPPLIES

LGS-6A SERIES

MP MASTER
MA28622

LAMBDA

LAMBDA ELECTRONICS MELVILLE, L. I., N. Y.



INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

LGS-6A SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LGS-6A models unless otherwise specified.

LAMBDA ELECTRONICS MELVILLE, L. I., N. Y.
MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

IM-LGS-6A

TABLE OF CONTENTS

Section	Page
SPECIFICATIONS AND FEATURES	1
OPERATING INSTRUCTIONS	5
Basic Mode of Operation	5
Connection for Operation	5
Supply Load Connections	5
Operation After Protective Device Shutdown	6
MAINTENANCE	7
General	7
Opening Unit for Trouble Shooting and Repair	7
Trouble Analysis	7
Checking Transistors and Capacitors	8
Printed Circuit Board Maintenance Techniques	8
Performance Checks	9
Adjustment of Calibration Control R204	9
SERVICE	10
PARTS ORDERING	10

SPECIFICATIONS AND FEATURES

DC OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I
VOLTAGE AND CURRENT RANGES

MODELS	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE			
		40°C	50°C	60°C	71°C
LGS-6A-5-OV-R	5±5%	90.0	83.0	73.0	57.0
LGS-6A-6-OV-R	6±5%	80.0	73.0	65.0	51.0
LGS-6A-12-OV-R	12±5%	45.0	41.0	36.0	29.0
LGS-6A-15-OV-R	15±5%	39.0	36.0	32.0	25.0
LGS-6A-20-OV-R	20±5%	30.5	27.5	24.3	19.0
LGS-6A-24-OV-R	24±5%	26.0	23.5	20.5	16.0
LGS-6A-28-OV-R	28±5%	22.5	20.5	18.0	14.0

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

REGULATED VOLTAGE OUTPUT

Regulation . . . . . 0.1% line or load with input variations from 105-132 or 132-105 volts AC and load variations from no load to full load.

Ripple and Noise . . . . . 10mV RMS, 35mV peak-to-peak for LGS-6A-5-OV-R, -6-OV-R models; 15mV RMS, 100mV peak-to-peak for LGS-6A-12-OV-R, -15-OV-R, -20-OV-R, -24-OV-R, and -28-OV-R with either positive or negative terminal grounded.

Temperature Coefficient . . . . . Change in output voltage 0.03%/°C max.

Remote Programming

External Resistor . . . . . Nominal 1000 ohms/volt output.

Programming Voltage . . . . . One-to-one voltage change.

Remote Sensing . . . . . Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

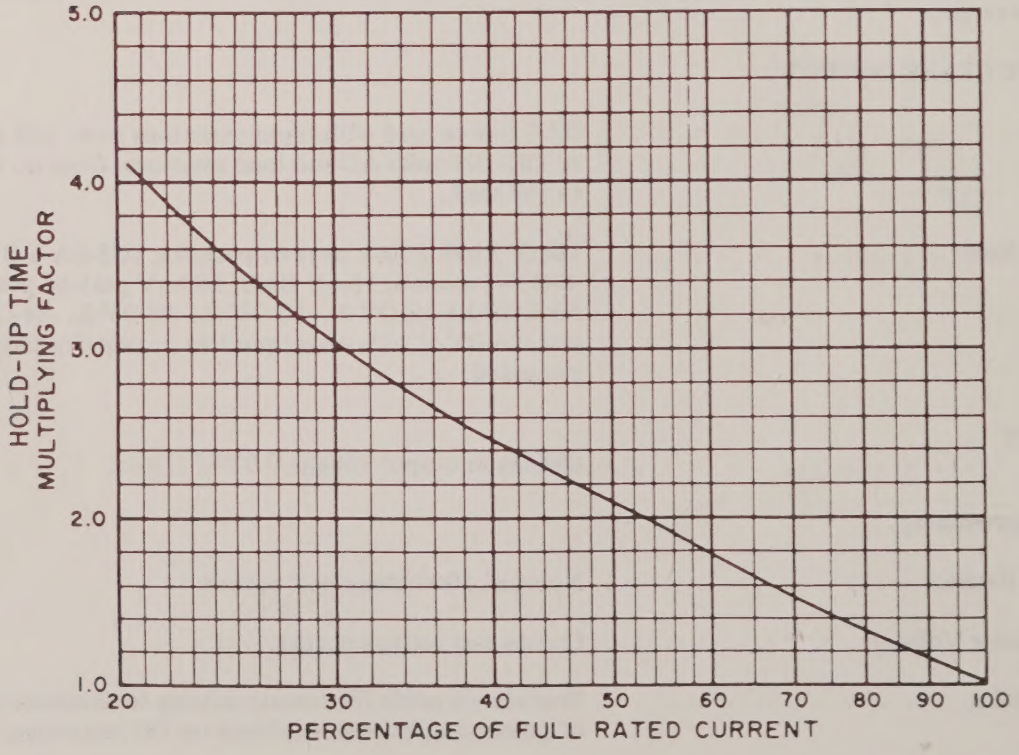
HOLD-UP TIME — Determine hold-up time regulation after input power failure as follows:

1. Find hold-up time at full rated current from chart below
2. Determine percentage of full rated current for desired application.
3. Find multiplying factor on graph below.
4. Apply hold-up time formula:

$$S = (F)\,(M)$$

where S = hold-up time
F = hold-up time at full rated current (see chart)
M = multiplying factor (see graph)

MODEL	HOLD-UP TIME (ms) AT FULL RATED CURRENT
LGS-6A-5-OV-R	18.0
LGS-6A-6-OV-R	17.5
LGS-6A-12-OV-R	3.0
LGS-6A-15-OV-R	4.5
LGS-6A-20-OV-R	6.0
LGS-6A-24-OV-R	2.0
LGS-6A-28-OV-R	1.0



OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

INPUT

AC Input . . . . . 105-132 VAC at 47-440 Hz. Input power: 960 Watts*. Input Current: 12.8 Amps**. For operation at frequencies above 440 Hz, consult factory.

*With output loaded to full current rating.
**With output loaded to full current rating and input voltage 105 VAC, 60 Hz.

DC Input . . . . . 145 VDC ±10%. Input power: 960 Watts†. Input current: 6.6 Amps††.

†With output loaded to full current rating.
††With output loaded to full current rating and input voltage 130 VDC.

INPUT FUSE — Fuse F1 protects the input wiring to the power supply. Overload of power supply does not cause fuse failure.

OVERLOAD PROTECTION

Thermal . . . . . Thermostat resets automatically when over-temperature condition is eliminated.

Electrical . . . . . Automatic electronic current limiting circuit, limits output current to a preset safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — All LGS-6A models include fixed built-in overvoltage protection circuits which prevent damage to the load caused by excessive power supply output voltage. See table below for overvoltage protector firing ranges.

MODEL	OVERVOLTAGE PROTECTOR TRIP-POINT RANGE (VOLTS)
LGS-6A-5-OV-R	6.3 — 6.9
LGS-6A-6-OV-R	7.1 — 7.7
LGS-6A-12-OV-R	13.3 — 14.1
LGS-6A-15-OV-R	16.5 — 17.5
LGS-6A-20-OV-R	22.1 — 23.5
LGS-6A-24-OV-R	26.5 — 28.1
LGS-6A-28-OV-R	30.9 — 32.9

INPUT CONNECTIONS — Terminal block on front of chassis.

OUTPUT CONNECTIONS — 1/4 - 28 studs on front of chassis.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0° C to 71° C ambient with corresponding load current ratings for all modes of operation.

STORAGE TERMPERATURE (non operating) — -55° C to 85° C

FUNGUS — All LGS-6A power supplies are fungus inert.

VDC ADJ. Control — Voltage adjust control permits adjustment of DC output over entire operating range.

PHYSICAL DATA

Size	3-3/16" x 7-1/2" x 15-1/8"
Weight	18.0 lbs. net; 21.0 lbs. shipping
Finish	Gray, FED. STD. 595 No. 26081

MOUNTING — One surface, with tapped mounting holes can be utilized for mounting this unit. LGS-6A power supplies must be mounted with Top facing up and in a horizontal plane. Refer to figure 10 for mounting details.

ACCESSORIES

Rack adapters	Rack adapters LRA-14, LRA-15, and LRA-17,used for ruggedized mounting with or without chassis slides, are available.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40° C. For continuous operation, load current must not exceed the rating for each ambient temperature. When rated load current is exceeded, voltage decreases towards zero and the current at short circuit is held to a safe value.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminal block and power studs on the front of the supply. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) AC or positive DC lead to terminal 1.

The supply positive terminal is brought out to terminal 6. The supply negative terminal is brought out to terminal 4. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 9. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the front output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3. Local sensing is the connection suitable for applications with relatively constant load or for applications with short power output leads.

Remote Sensing Connection, Figure 4. Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at a nominal 1000 ohms/volt change and a shorting-type switch as shown in figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will nominally be minimum output voltage plus 1 volt per 1000 ohms.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of the programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 1 ma. minimum.

Alternatively, when supplies with less than 1 ma. reverse current capability are used, a resistor capable of drawing 1 ma. at the minimum programming voltage must be connected across the output terminals of the programming supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections For Series Operation, Figure 7. The voltage capability of LGS-6A power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I, of SPECIFICATIONS AND FEATURES, for power supply current and voltage ratings.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown. The thermostat shuts down inverter operation only when the temperature of the main rectifier heat radiator exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value.

Fuse Shutdown. Fuse will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

Overvoltage Shutdown. When the power supply output voltage increases above the overvoltage limit, HC1 will short circuit output of the supply and SCR101 will shut down inverter operation. After eliminating the cause(s) for overvoltage, resume operation of the supply by interrupting the AC input circuit for a period of twenty seconds. (refer to TROUBLESHOOTING CHART)

MAINTENANCE

GENERAL

This section describes trouble analysis routine, calibration and test procedures that are useful for servicing the Lambda power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on SPECIFICATIONS AND FEATURES for the minimum performance standards.

OPENING UNIT FOR TROUBLESHOOTING AND REPAIR

Whenever it is necessary to troubleshoot and repair the Lambda LGS-6A power supply, open the unit as follows:

Access For Troubleshooting.

1. Remove top cover by unscrewing the 12 counter-sink screws that hold it in place.
2. Remove 3 counter-sink screws on the bottom left hand side, as viewed from input-output terminals.
3. Remove 2 pan-head screws on left-hand side (one at each end in center of unit).
4. Rotate left-hand side 90° counter-clockwise as viewed from input-output terminals.

The above 4 steps allow access to unit and unit can be operated in this configuration of disassembly.

Access To Power Transistors, Input Rectifiers, Power SCR, Input Cap, And Snubber Board.

1. Remove 4 screws that hold U-shaped P.C. bracket to left-hand side.
2. Rotate P.C. bracket into unit.

Unit must not be operated in this configuration of disassembly.

Access To EMI Components And Front Deck.

1. Remove 2 flat-head screws from bottom front of unit.
2. Remove 1 pan-head screw on right side in center at front end of unit.
3. Remove 2 ¼-28 nuts that attach buss bars to studs.
4. Front-deck can now be moved to the limit of wire slack.

Unit must not be operated in this configuration of disassembly.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunction before troubleshooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 8, as an aid to locating troulbe causes. The schematic diagram contains various circuit voltages that are averages for normal no load operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an in-circuit transistor checker. If no checker is available, transistors can be checked with an ohmmeter that has a highly limited current capability. Observe proper polarity for PNP or NPN to avoid error in measurement. The forward transistor resistance is low but never ZERO; backward resistance is always higher than the forward resistance.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional faulty components could damage the replaced component.

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers or a commercial heat sink device placed between the component and the solder joint.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact, but not covered with solder, it is a good contact. Do not attempt to cover with solder.
2. Voltage measurements can be made from either side of the board. Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to measuring instrument.
3. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.
4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.
5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:
   a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.
   b) Dip the wick in liquid rosin flux.
   c) Place the wick onto the soldered connection and apply soldering iron onto the wick.
   d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 9. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the no load to load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a TVM, John Fluke Model 931B or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL R117

Whenever R117 is replaced, and voltage and current indications do not reflect maximum ratings, adjust R117 as follows. The adjustment procedure requires that the power supply is operating.

This is preset at factory and should not require readjustment.

1. Remove top cover and locate R117. R117 is located on top center of control P.C. board.
2. Connect a 110% load and apply AC power to unit.
3. Adjust R117 for a 10% drop in output voltage. Adjust clockwise to increase and counter-clockwise to decrease voltage.
4. After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R117 to resistor housing.
5. After sealing, check setting and repeat adjustment procedure if required.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available throught any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not electronic part, or is not listed, provide a description, function, and location, of the part.

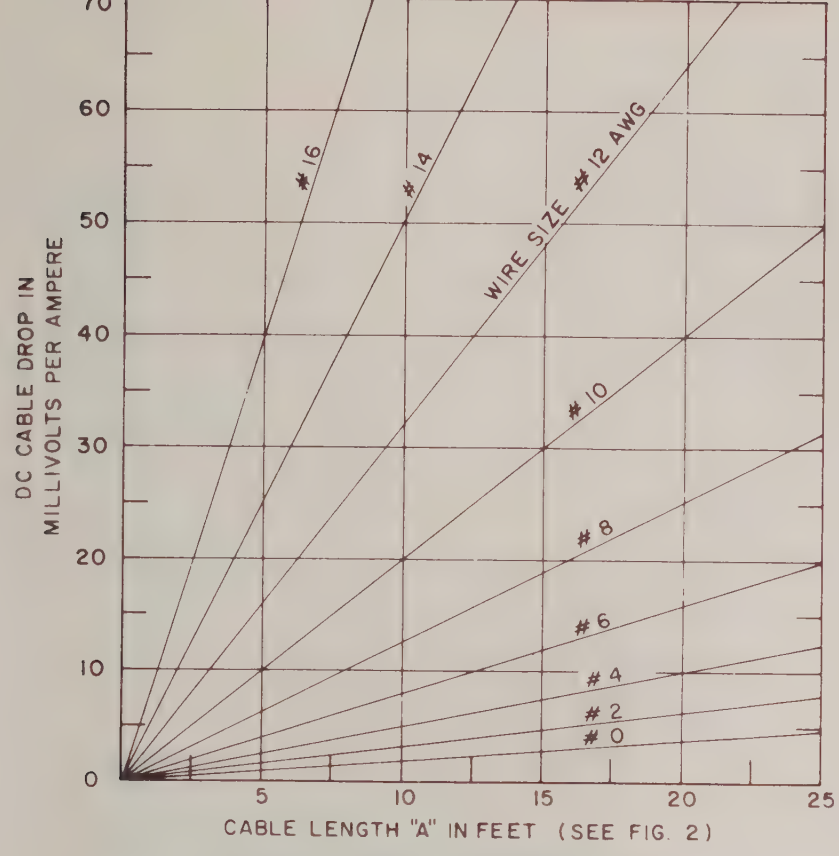


Figure 1. Cable Connection Chart.

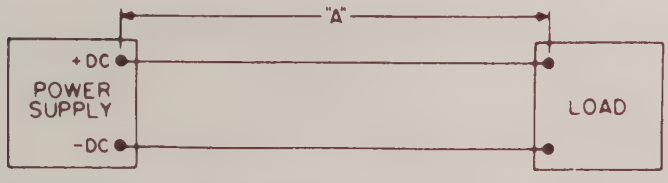
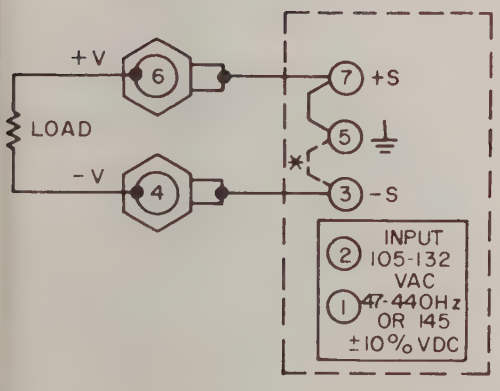


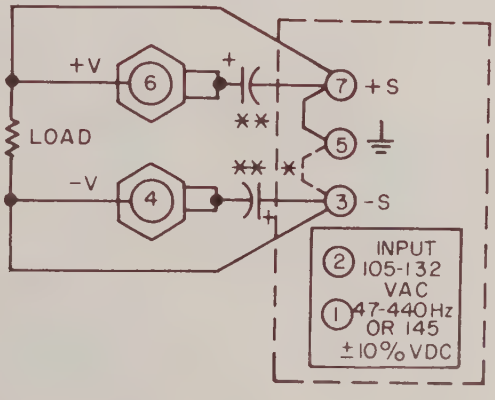
Figure 2. Cable Length "A" in Feet.



E

FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 5 AND 3.

Figure 3. Local Sensing Connections.

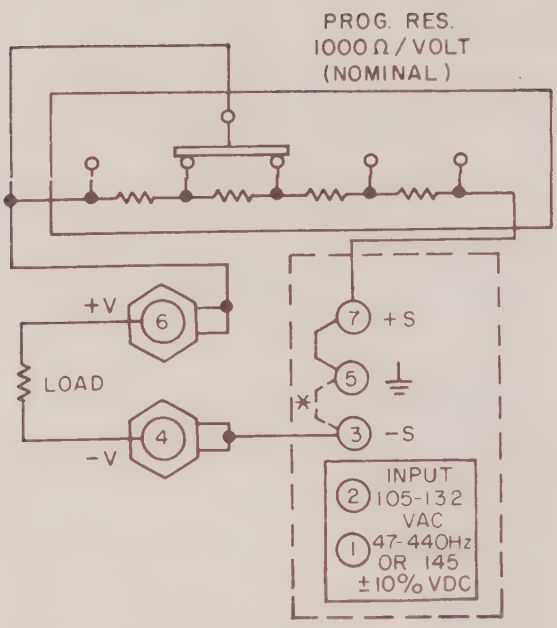


NOTE

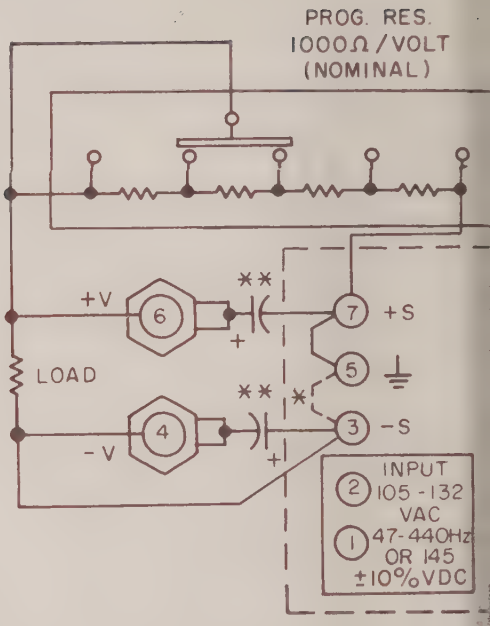
* FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 5 AND 3.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 4. Remote Sensing Connections.



(A) LOCAL SENSING

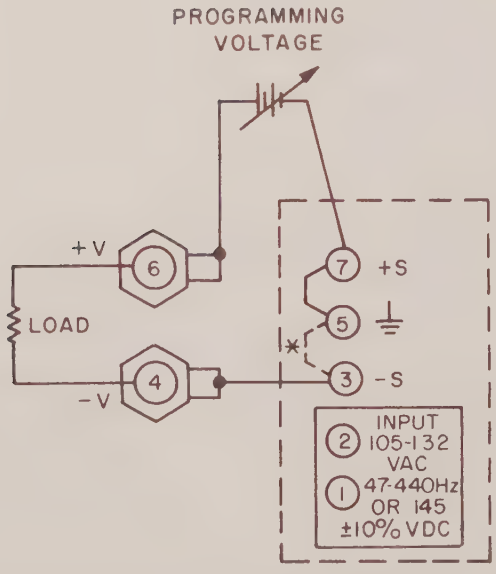


(B) REMOTE SENSING

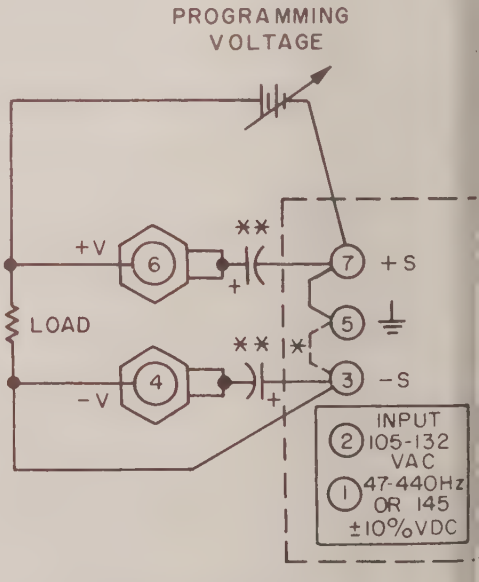
NOTES: * FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 3 AND 5.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 5. Programmed Voltage, With External Resistor.



(A) LOCAL SENSING

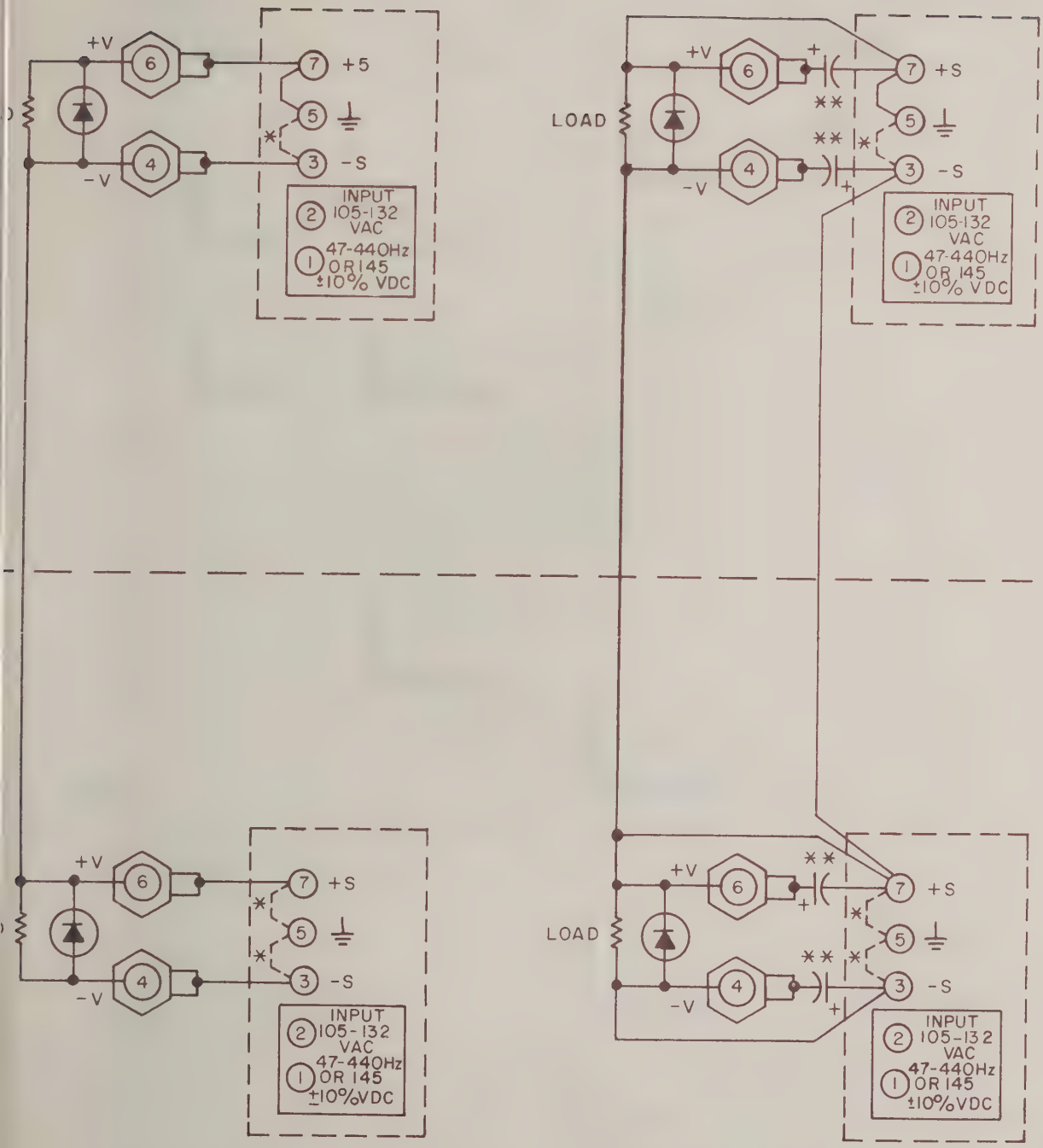


(B) REMOTE SENSING

NOTES: * FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 7 AND RECONNECT TO TERMINALS 3 AND 5.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 6. Programmed Voltage, With External Programming Voltage Source.



NOTES:

* MAKE ONLY ONE GROUND CONNECTION FOR SERIES COMBINATION. TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS 5 AND 7 ON TOP UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE.

** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 7. Series Connection.

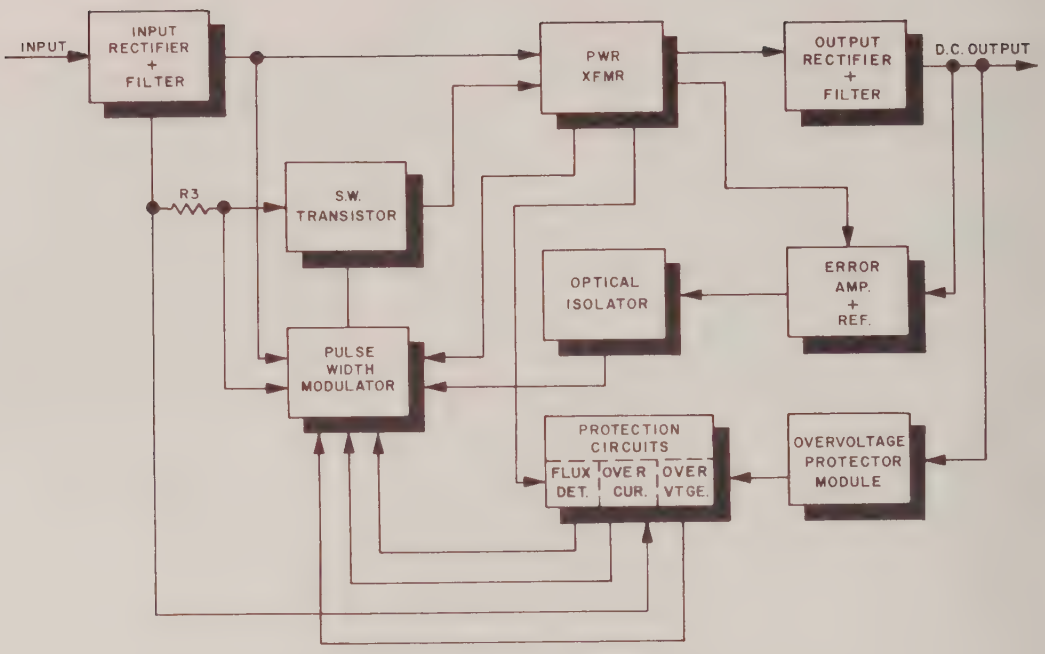
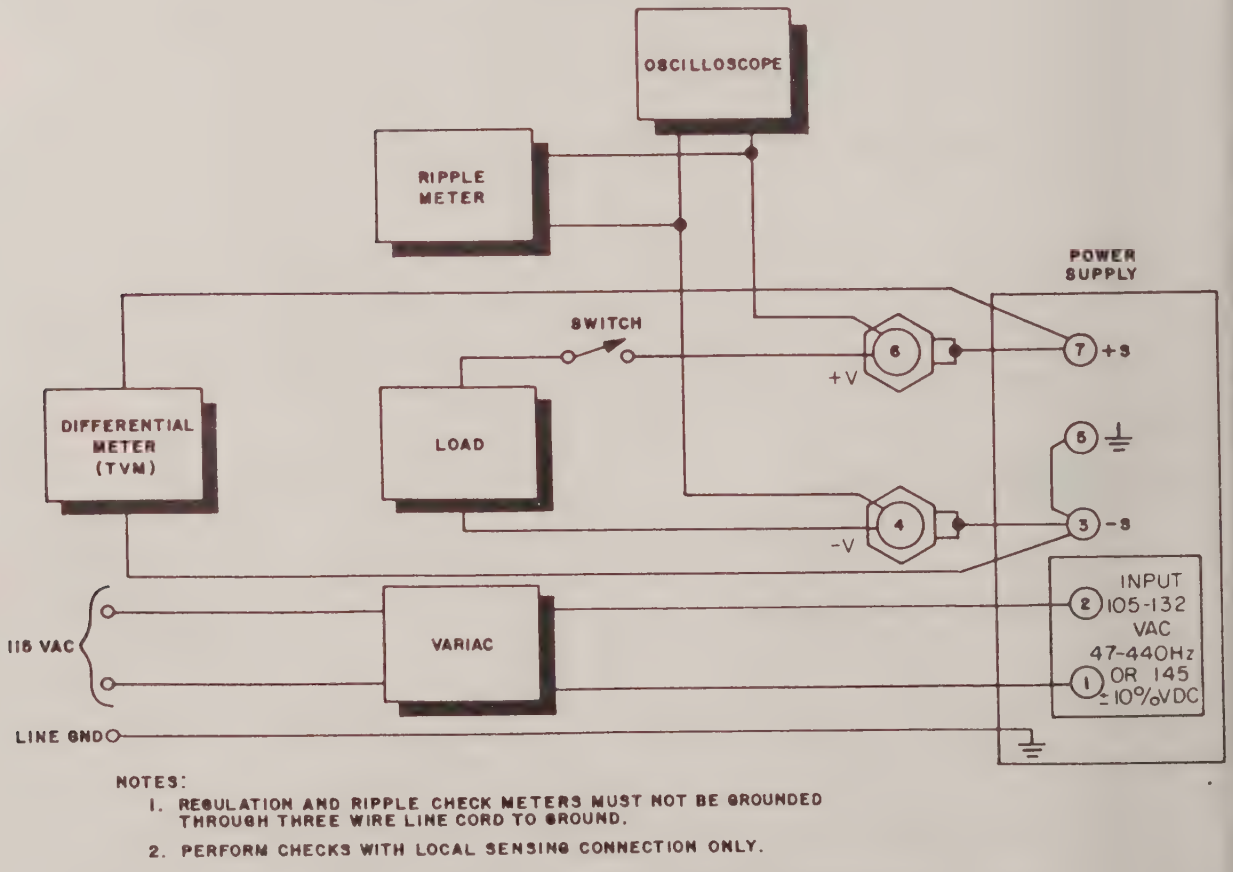


Figure 8. Typical Block Diagram



NOTES:

1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTION ONLY.

Figure 9. Test Connections for Performance Checks

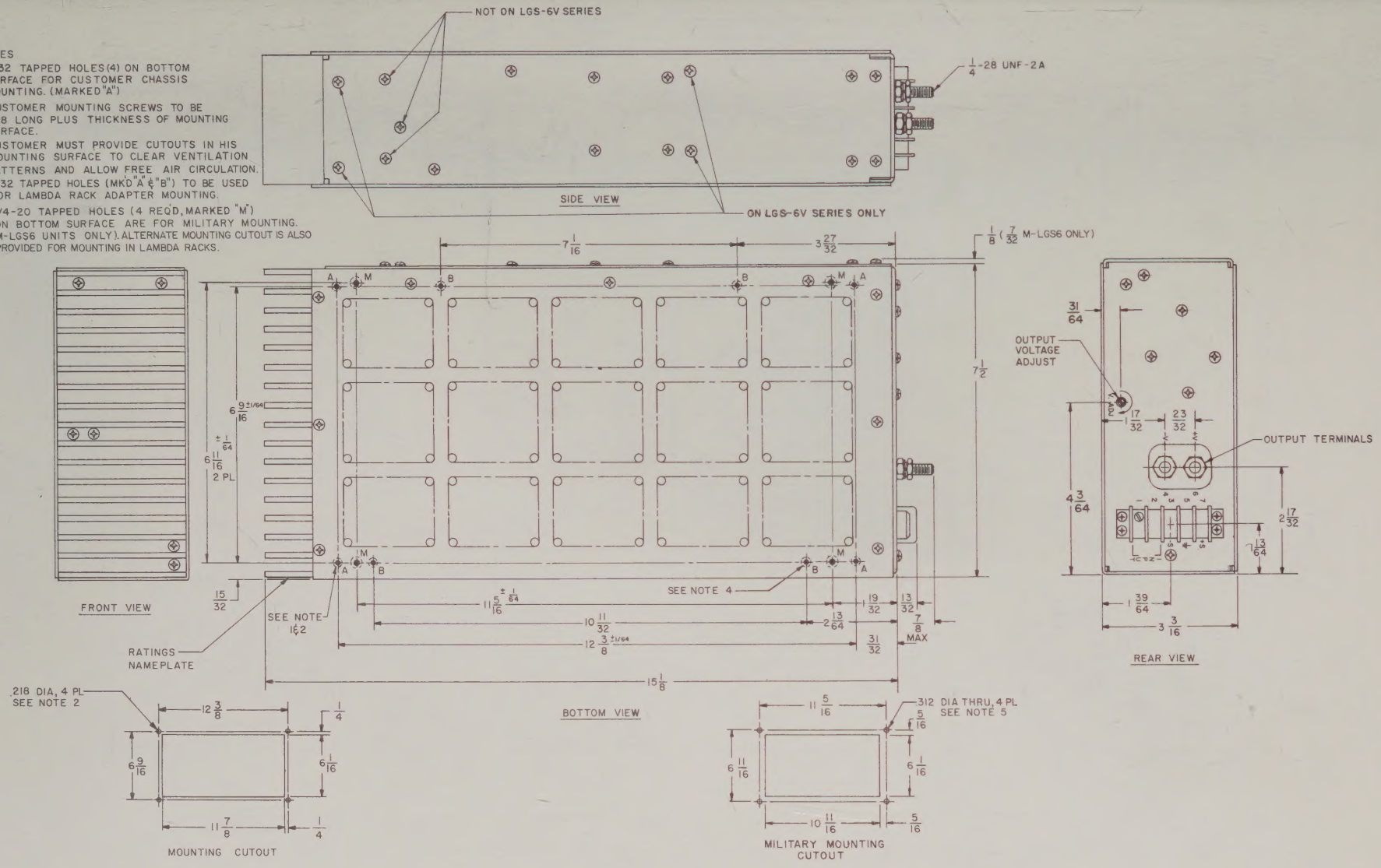
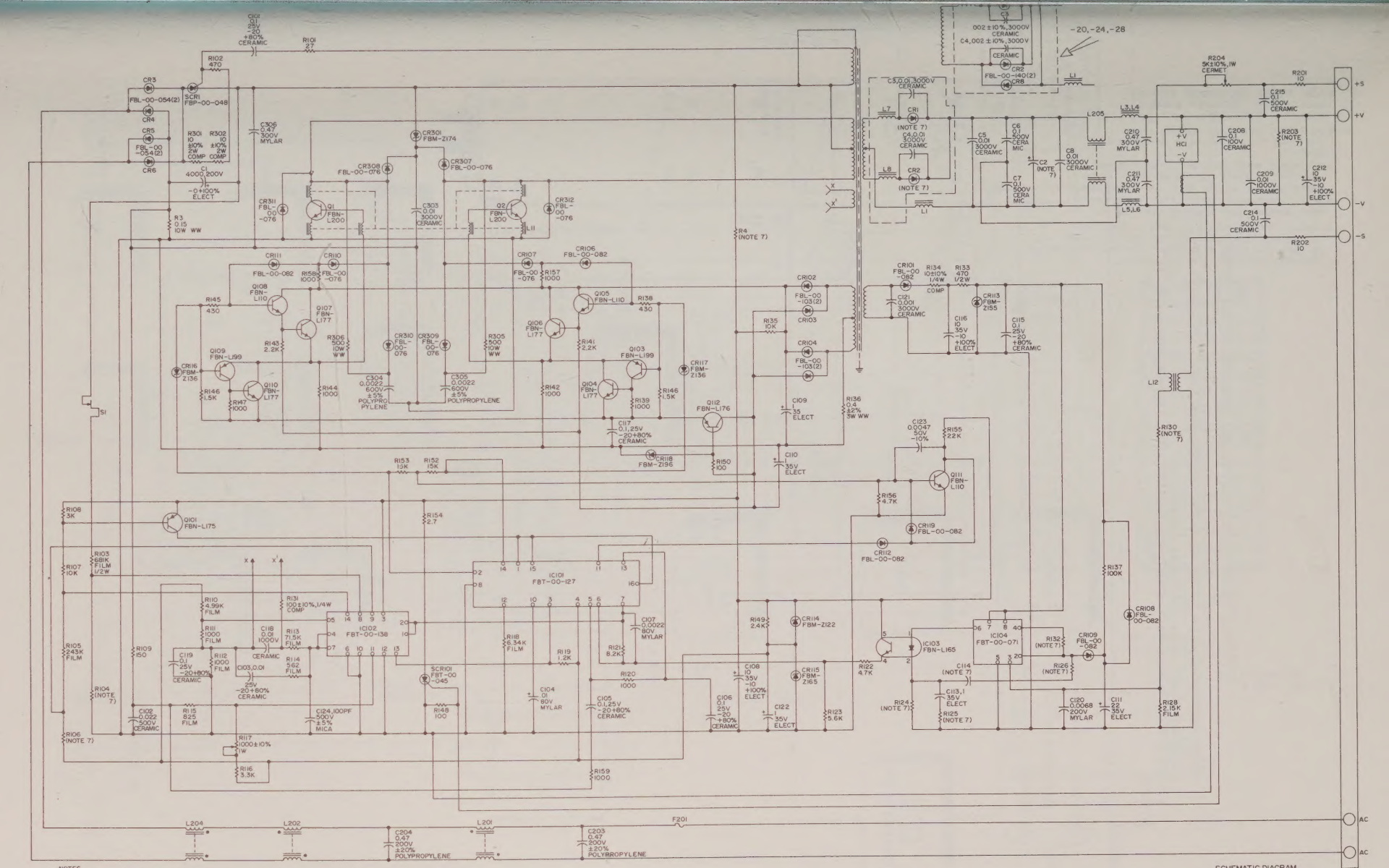


Figure 10. Outline Drawing



NOTES

1. RESISTORS ARE 1/4W CARBON FILM WITH VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITOR VALUES ARE IN MICROFARADS UNLESS UNLESS OTHERWISE NOTED.
3. RESISTOR TOLERANCES: CARBON FILM ±5%, WIREWOUND ±5%, FILM ±1%.
4. CAPACITOR TOLERANCES: ELECTROLYTIC ±20%, CERAMIC ±20%, MYLAR ±10% UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - ▭ INDICATES ACTUAL UNIT MARKING
   - ↓ INDICATES CLOCKWISE ROTATION OF SHAFT
   - * SEE INSTRUCTION MANUAL
   - —o— INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
   - ⊘ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
7. SEE TABLE 1 FOR COMPONENT VALUES.

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.

DOTTED CONNECTIONS SHOWN ON TB1 INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY

MODELS	
LGS-6A-5-OV-R	LGS-6A-20-OV-R
LGS-6A-6-OV-R	LGS-6A-24-OV-R
LGS-6V-12-OV-R	LGS-6A-28-OV-R
LGS-8A-15-OV-R	

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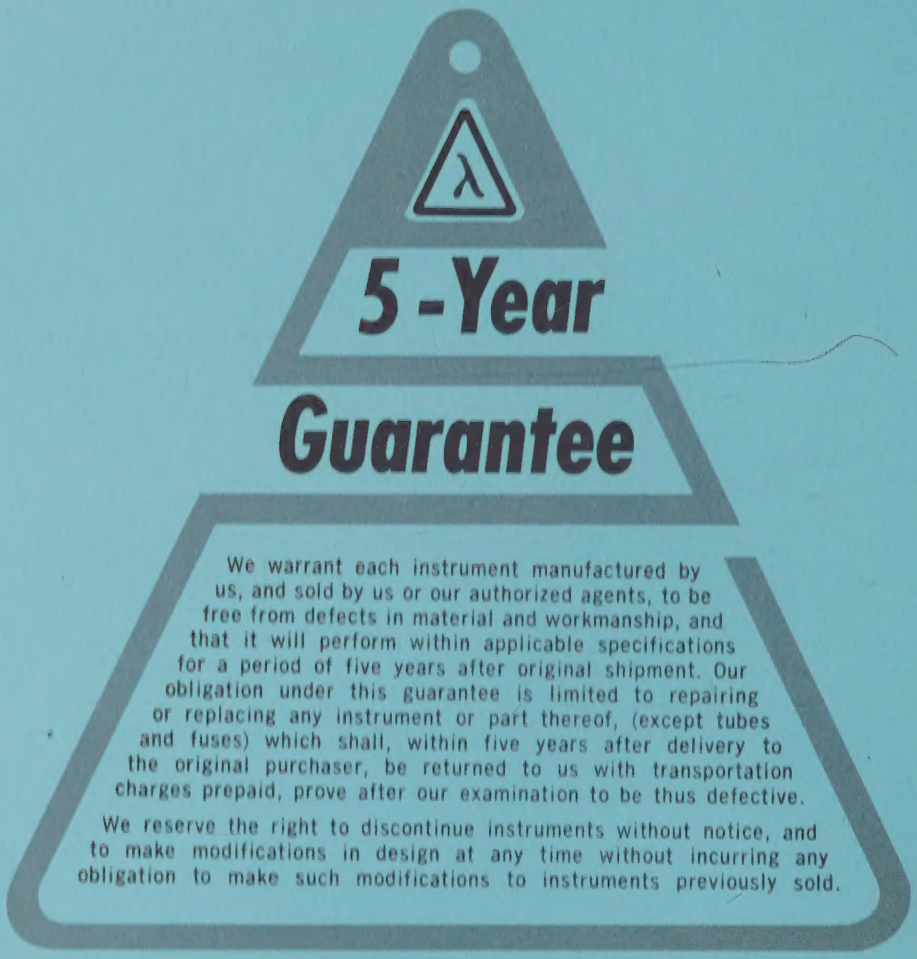
ELECTRONICS
MELVILLE, NEW YORK
DIVISION OF (Veeco) INSTRUMENTS INC.


5-Year
Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

LAMBDA ELECTRONICS
515 BROAD HOLLOW ROAD • MELVILLE, L. I., NEW YORK • 516 MYRTLE 4-4200

DIVISION of Veeco INSTRUMENTS INC.

MP MASTER
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